ID9- RAMICA OWEN: PERFORMING AUTOMATIC MICROBIOLOGICAL CULTURES

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Abstract
This article presents the RAMICA owen. The whole RAMICA sensor is able to implement a complete culture of bacteria inside a buoy. It does a culture every day, for 3 months, and sends data in real time. This allows to monitor the evolution of bacteriological contamination and relate it with what it is happening in human doing.
RAMICA sensor is a certified laboratory. It implements the MPN (Most Probable Number) Standard Method using 51 separated cells. In each cell it uses different light illumination (white or ultra violet) and its oven can work at different temperatures. With the right combination of lightning and temperature, it can culture Total coliform, Enterococcus and Ecoli.

Keywords - RAMICA sensor, microbiological quality of waters, bacteriological contamination, coliform contamination.

I. INTRODUCTION
The RAMICA sensor has been developed in a 'Retos Colaboración' project in the University of Vigo (http://ramica.cetmar.org/). To implement the IDDEX protocol it is necessary to separate the culture in 51 independent cells. Depending on the number of 'positive cells' it gives a Most Probable Number of bacteria in the water under control.
To be able to split the culture in cells, and posterior cleaning, of the cells, in the Ramica owen we use a flexible catheter (culture catheter in Fig. 2) that is smashed in 52 points along the catheter. To read the color of the cells a very sensible color sensor has been implemented in each cell.
This color sensor consist of one white led (used to light in order to see the visual color of the culture), one ultraviolet led (used to light in order to see if the culture has fluorescence), and one PIN color sensor with 16 individual sensors: 4 in red, 4 in green, 4 in blue and 4 in white.
The color sensor of each cell pretends to be able to read the color of the liquid inside the catheter with very good precision. What it really reads is the light going out of the culture catheter when it is lighted with white or uv lightning from outside it and, in actual version, the diodes and the PIN color sensor are located in the same side.
The sampling of the water to analyze is done by means of a Hidroboya, which let us to pick the sample at any depth in the water column. In actual development there is an intermediate sample chamber that is difficult to disinfect and guarantee not any rest of biocide remains in it. If the depth of sample is not great (10 meters or less) the sample is took directly by the hydraulic part of the RAMICA owen which guarantees the disinfection process.
The hydraulic part of the RAMICA owen (we call it preowen) consist of several peristaltic pumps, valves and sensors and an electronic board responsible of the control of every sensor and active element.
The pre-owen performs the mixing processes to create the culture and moves it to the owen. That is, it mix 10 ml of sea water to analyze, with 90 ml of distilled water (in a deposit inside the RAMICA buoy) and with the IDDEX nutrient. The IDDEX nutrient has been previously dissolved in water (in order it to be easily moved by peristaltic pumps) and it is kept in the buoy at low temperature (in order it to remain active the 3 months that RAMICA buoy has been designed to work before it needs a maintenance process).
The owen is pre heated while the pre-owen performs the mixing in order the owen start to do the culture in the established temperature in a few minutes.
The pre-owen moves the mixing to the culture catheter in the owen. Then, an electric motor press the smash mechanical pieces against the catheter bed (Fig. 2) closing the owen. That crushes the culture catheter, splitting the culture in 51 separated cells. It also closes the first insolation box wrapping the owen.(Fig. 2) The control of the stove board adjust the temperature with a precision of 0,2 degrees. The culture process is running.
The definte MNP value is computed with the positive cells after 18 hours. Anyway, we read the cells every 3 or 6 hours. Then, the data is sent to the server in land.

CONCLUSIONS
The RAMICA sensor has been developed and with it, real time microbiological control can be performed. Many problems have been solved. The actual version is not ready to the market but it will be in a few months.

FUTURE LINES
Make the culture catheter as a connection of cylinders of glass (in the cells) with pieces of flexible catheter (in the smashed parts). This may solve the color sensor problem with the strange interaction between catheter and nutrient of the culture.

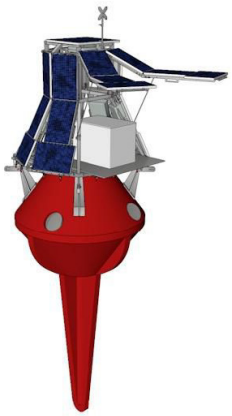

Fig. 1: Synthetic image of the whole buoy with solar panels and the box with the owen where the cultures are done.

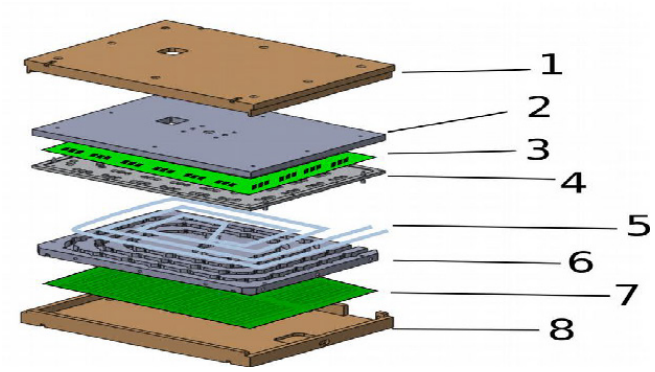

Fig. 2: Exploded view of the owen:
1, 8) first insulation box, 2, 4, 6) smash mechanical pieces and catheter bed (6), 3) colorimetry board, 5) culture catheter, 7) stove board,